

NED software for forest management: much more than cruising¹

Mark J. Twery

Research Forester, USDA Forest Service, Northeastern Research Station, Aiken Forestry Sciences Laboratory, PO Box 968, 705 Spear St., Burlington, VT 05402-0968, 802-951-6771

H. Michael Rauscher

Research Forester, Bent Creek Experimental Forest, Southern Research Station, USDA Forest Service, Asheville, NC 28806

Abstract

The term NED describes a set of computer programs intended to help resource managers and landowners develop goals, assess current and potential conditions, and produce sustainable management plans for forest properties. NED-1 helps analyze forest inventory data from the perspective of various forest resources for management areas up to several thousand acres. The electronic data collection program NEDDC interfaces directly with NED-1 to facilitate use of field data recorders. Programs such as the Forest Stewardship Planning Guide and NEWILD allow people with an interest in managing their forests but lacking detailed data to improve their understanding of various management activities and their effects on the forest. StewPlan, the latest release, is a form-generating program that helps prepare stewardship plans that meet the requirements of the USDA Forest Service Stewardship program. The resources NED addresses include visual quality, ecology, forest health, timber, water, and wildlife, allowing a user to evaluate the degree to which individual stands or a management unit as a whole may provide the conditions required to accomplish specific goals. Users can select from a variety of reports including tabular data summaries, general narrative reports, and goal-specific analyses. An extensive hypertext system provides information on resource goals, the desired conditions that support achieving those goals, and related data used to analyze the actual condition of the forest, as well as detailed information about the program itself and the rules and formulas used to produce the analyses. Further development, currently known as NED-2, will enhance that capability of the software to incorporate cutting treatments and simulate development of forests through time and allow data collection with inexpensive handheld computers. The programs are being developed by the USDA Forest Service's Northeastern and Southern Research Stations in cooperation with many other organizations and individuals.

Introduction

Deciding how to manage forest property can be complex and sometimes difficult, especially if many goals need to be met in one area. Keeping track of lots of information and making many calculations are things that computers do very well. NED is a family of computer programs designed to provide prescriptions and analysis for managing forests for multiple values on a landscape scale. Some of these programs are in wide use by a variety of forestry professionals throughout the Northeastern United States, and others are being used by

¹ The use of trade or firm names in this article is for reader information and does not imply endorsement by the U. S. Department of Agriculture of any product or service.

landowners, educators, and school children interested in what makes up their forests and how various activities may affect the landscape.

Each program associated with NED addresses a different need in the process of deciding what to do to manage forested lands. Some NED products help create stewardship plans and help professional foresters develop management strategies. Other NED products help do outreach and education to students and owners of nonindustrial private forests (NIPF). NED includes the best tools available to illustrate to NIPF landowners why and how they should manage their lands to achieve their stewardship goals without telling anyone what the right thing to do may be. This emphasis on supporting the decisions of the landowner or manager through analysis and expert advice means that we do not allow NED to come up with "the right answer". Instead, we try to provide users of the software with a general understanding of their situation while using data collected from their woods to help analyze specific questions. The key is that through this approach we are able to help people consider multiple benefits and the tradeoffs among them.

The intended users of NED include all who are interested in management of forest land, principally those responsible for the individual management decisions on specific units of land. Current capability of the program focuses on the northeastern United States but is being expanded. The NED system will facilitate translation of general goals into specific and compatible goals. NED will then be able to conduct specific analyses of management recommendations for units of land with these goals. Silviculture often heads the list of tools used by resource managers to achieve their goals. In its broadest sense, silviculture includes both direct and indirect manipulation of forest vegetation. The most direct and most traditional method familiar to foresters is cutting trees, but planting, burning, and other activities are also part of silviculture. NED attempts to provide as much information as possible to a user regarding possible management goals for a particular property, the conditions necessary to meet those goals, and possible silvicultural activities that can help move conditions in the forest closer to the desired ones. Thus, the two primary groups of users envisioned are consulting foresters, either private or service foresters, and public forest resource managers such as district-level managers on state or national forests. Private landowners without training in resource management can use parts of the system without assistance but are not expected to utilize NED's full capabilities. Training in the use of some of the programs is likely to be helpful even to professional natural resource management practitioners.

NED software is being developed by researchers in the USDA Forest Service affiliated with the Northeastern Research Station and the Southern Research Station, in cooperation with many other forestry experts. The term NED originally stood for "North East Decision model", but since the programs have begun to address issues outside the Northeast, we no longer consider it an acronym, but merely the name of a friendly assistant, like Fred or Ted or Ed.

Available Programs

To facilitate useful input from potential users in the design of the system, NED's developers have chosen to release independent software programs in stages. The initial freestanding programs such as NED/SIPS (Simpson *et al.* 1995), NEWILD (Thomasma *et al.* 1998), and the Forest Stewardship Planning Guide (Alban *et al.* 1995) have a large body of users, have generated considerable comment, and have influenced the design of additional software. These programs are available for downloading at <http://www.fs.fed.us/ne/burlington/ned>. StewPlan is still in its testing phase, but it is also

available at the NED web site.

NED-1 is a Windows® program that emphasizes the analysis of forest-inventory data from the perspectives of various forest resources (Twery *et al.* 2000). The resources it addresses include visual quality, ecology, forest health, timber, water, and wildlife. The primary function of NED-1 is to evaluate the degree to which individual stands, or the management unit as a whole, provide the conditions required to accomplish specific goals. An extensive help system provides the user with information about user-identified resource goals, the desired conditions that support achieving those goals, and related data used to analyze the actual condition of the forest. NED-1 is designed to begin to integrate the pieces from the initial programs into a single interface. It includes the multiple-resource, multiple-value goal sets defined within the Forest Stewardship Planning Guide, the evaluation of wildlife habitat as represented in NEWILD, and much of the timber inventory summary and economic analysis provided in NED/SIPS. NED-1 adds the complexity of a multiple-stand management unit and provides analysis for an entire management unit as well as the individual stands separately, so the user can evaluate conditions across the entire property.

The screenshot shows the NED-1 software window titled "NED-1: NEWILDC (SAMPLE).ND". It has a menu bar (File, Edit, Run program, Help) and a toolbar. On the left is a tree view with categories: User, Goals, Data, Analysis, Displays, Reports, Goal Completion, Stand Comparison, Species x Diameter, and ST 1315. The main window displays a table titled "Stems per unit area (stems/act) - AGS, UGS, Crop." with a "Configure..." button. The table has columns for EH, SM, BC, AB, RM, and total. The rows represent different resource goals, with values for each goal across the different resource categories.

	EH	SM	BC	AB	RM	total
<1.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0	0.0	0.0	0.0	0.0	0.0	0.0
4.0	0.0	0.0	0.0	22.9	0.0	22.9
6.0	15.3	0.0	5.1	0.0	0.0	20.4
8.0	48.7	14.3	0.0	0.0	0.0	63.0
10.0	7.3	16.5	7.3	3.7	0.0	34.8
12.0	5.1	7.6	3.8	2.5	1.3	20.4
14.0	0.9	19.6	6.5	0.0	2.8	29.8
16.0	0.7	10.0	2.1	0.0	0.0	12.8
18.0	0.6	3.4	1.7	0.6	1.1	7.4
20.0	0.5	0.0	3.2	0.5	0.0	4.2
22.0	0.0	0.0	3.8	0.0	0.0	3.8
24.0	0.0	0.6	0.6	0.0	0.0	1.2
>=25.0	0.0	0.0	0.0	0.0	0.0	0.0
total	79.4	72.2	34.3	30.2	5.2	220.9

The inventory and data entry system for NED-1 is extremely flexible. It includes many variables not generally inventoried by traditional foresters, including a variety of understory and ground layer characteristics, so that the inventory may be evaluated for visual resources and wildlife habitat. However, if a user is interested only in some characteristics, the data entry forms can be modified to match the variables collected. A data collection and transfer program, NEDDC, is available to facilitate use of NED-1 with portable data recorders that run the DOS® operating system.

The **Forest Stewardship Planning Guide** (Alban *et al.* 1995) is designed to provide people with exposure to and explanations of a wide range of forestry practices used to produce a variety of benefits from forests. The program begins by giving a user extensive background information on forests in general, then attempts to elicit the landowner's goals for the forest. The Windows®-based program guides the user through a process of selecting forest stewardship goals. This program makes limited recommendations on managing a forest for specific goals and describes the conditions that must be created or enhanced to accomplish them. Many landowners in New York,

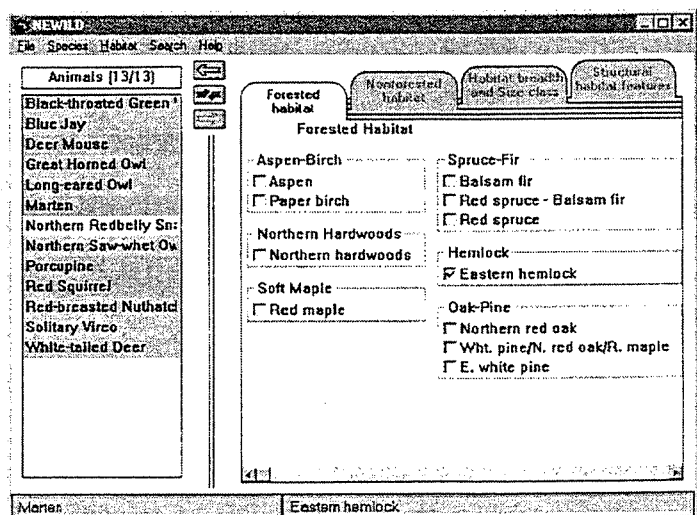
The screenshot shows the "Forest Stewardship Planning Guide" window. It has a menu bar (File, Options, MoreInfo) and a title bar "Fitting Your Plans Together". The main window contains a table with rows representing different forest goals and columns representing different forest characteristics. The cells contain checkmarks or plus signs indicating compatibility or requirements. At the bottom, there are buttons for "Making Plans", "Print Report", and "Summary of Plans".

	all can	dense un	big trees	board ft	tim flow	warm fish	cold fish	bluebird	r grouse	h thrush
Visual: continuous tall canopy	+	+	+	+	+	+	+	+	+	+
Visual: dense understory/open canopy	+	+	+	+	+	+	+	+	+	+
Visual: big tree appearance	+	+	+	+	+	+	+	+	+	+
Wood: produce board feet	+	+	+	+	+	+	+	+	+	+
Water: limit peak water flows	+	+	+	+	+	+	+	+	+	+
Water: warm-water fishes	+	+	+	+	+	+	+	+	+	+
Water: cold-water fishes	+	+	+	+	+	+	+	+	+	+
Wildlife: eastern bluebird	+	+	+	+	+	+	+	+	+	+
Wildlife: ruffed grouse	+	+	+	+	+	+	+	+	+	+
Wildlife: hermit thrush	+	+	+	+	+	+	+	+	+	+

Pennsylvania, and elsewhere have found this a very helpful introduction to the possibilities available to them as they contemplate doing things in the forest. Many people have found it most useful in the way it allows them to compare and contrast the compatibility of various management goals. Successful workshops for landowners have been held in several northeastern states using this software. Numerous private consulting foresters use this program to introduce forest management topics to new clients. The Planning Guide requires no actual forest inventory or data from the woods, so it is easy to use in a classroom setting and has been adopted by several high schools and colleges as part of their curriculum.

NED/SIPS (Simpson *et al.* 1995), a program subtitled Stand Inventory Processor and Simulator (SIPS), provides a means of creating, managing, and analyzing forest-inventory records at the stand level. Its interface simplifies entering and editing stand-inventory data. Once data are entered, many analytical tools are available to help understand and evaluate the data. A variety of reports can be generated to describe the vegetation structure, timber value, and economics of the stand. Users can apply any of a set of standard treatments to the stand or design a customized cutting scheme, and use one of the four incorporated stand-growth simulators (NE TWIGS, SILVAH, OAKSIM, and FIBER) to show what the stand may look like in the future. NED/SIPS runs in DOS and is subject to difficulties inherent to that system, but it is reasonably robust and has proved useful to many foresters over the past 5 years. The NED/SIPS interface features pull-down menus and context-sensitive help, access to four growth-and-yield simulators using the same data file format, overstory summary tables for common measures of stand characteristics (such as density, species, and volume), and economic analyses of incomes and expenses over time.

NEWILD, published in 1998 (Thomasma *et al.* 1998), is designed to provide access to and evaluation of information on species-habitat relationships for 338 terrestrial vertebrate species in New England. This program is based on publications by DeGraaf and Rudis (1986) and DeGraaf *et al.* (1992) that describe the habitat conditions used or preferred by these species of birds, mammals, reptiles, and amphibians. A portion of the text from these publications has been incorporated into the HELP portion of NEWILD. A user can provide NEWILD with a habitat description and determine what species might be likely to use the area, or ask the program to identify the habitat preferences of a particular species of interest. Most of the species addressed in NEWILD are present in Pennsylvania, and most have equivalent habitat requirements. There are some exceptions, such as the white-tailed deer rarely needing a protected wintering area in Pennsylvania, but the vast majority of requirements are the same. The wildlife habitat analyses in NED-1 are based on the same sources as in NEWILD, but have been adapted to Pennsylvania conditions.



StewPlan, a program just released for testing in the summer of 2001, is available from the NED web site. (Knopp and Twery, <http://www.fs.fed.us/ne/burlington/ned>). This software provides a standardized format for preparing a stewardship plan in conformance with all current guidelines for the Forest Stewardship program as administered by the USDA Forest Service, State and Private Forestry. StewPlan is designed to be used by consulting foresters and service foresters charged with the responsibility of preparing stewardship plans, but it is simple enough to use so that typical landowners familiar with computers could use it as well, provided they had the necessary resource expertise. Using a typical Windows-style interface, StewPlan facilitates entry of data for identification and description of a forest property, detailed descriptions of existing conditions, management goals, and specifications of anticipated activity for the duration of a plan. It provides a convenient summary in printed form as its primary output.

Forest stewardship plan for Mr. and Mrs. D. Sapsed		
DETAILED PLANS BY YEAR		
- 2001 -		
UNIT	PRIORITY	ACTIVITY
Areas 1,2,7	3	plant bur oak
Areas 4,9-11	6	Remove drainage tile wherever it has become exposed.
- 2002 -		
UNIT	PRIORITY	ACTIVITY
Area 15	2	Do a small clearcut to encourage development of red ash seedlings.
sugaring area	5	Install interpretive signs along the proposed trail route.
- 2003 -		
UNIT	PRIORITY	ACTIVITY
Areas 1,2,7	2	Remove trash and other pollution from the stream.
- 2004 -		
UNIT	PRIORITY	ACTIVITY
Areas 1,2,7	1	Thin down to 70% relative density, removing trees with the poorest form.
Areas 4,9-11	1	Remove the basswood stems to encourage growth of sweet white oak.
sugaring area	13	Repair the plastic tubing on the north side of the area.
- 2015 -		
UNIT	PRIORITY	ACTIVITY

Acknowledgments

Many more than 100 people have contributed to the development of NED software through participation on committees, testing of preliminary versions, or providing financial or moral support. Suffice it to say that without their hard work and dedication, NED and NED-1 would not have been possible. We are most indebted to David A. Marquis, whose vision and energy conceived the project and sustained its early development.

References

- Alban, L.M., Thomasma, S.A. and Twery, M.J. 1995. Forest stewardship planning guide user's manual (Version 1.10) [Computer program]. Gen. Tech. Rep. NE-203. Radnor, PA.: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 15 p. [Computer disk].
- DeGraaf, R.M. and Rudis, D.D. 1986. New England wildlife: habitat, natural history, and distribution. Gen. Tech. Rep. NE-108. Broomall, PA.: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 491 p.
- DeGraaf, R.M., Yamasaki, M., Leak, W.B. and Lanier, J.W. 1992. New England wildlife: management of forested habitats. Gen. Tech. Rep. NE-144. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 271 p.
- Simpson, B.T., Kollasch, R.P., Twery, M.J. and Schuler, T.M. 1995. NED/SIPS user's manual:

Northeast decision model stand inventory processor and simulator (Version 1.11) [Computer program]. Gen. Tech. Rep. NE-205. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 103 p.

Thomasma, S.A., Thomasma, L.E. and Twery, M.J. (1998) NEWILD (version 1.0) user's manual.[Computer program] Gen. Tech. Rep. NE-242. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 28 p. [1 computer disk; user's manual].

Twery, M. J., H. M. Rauscher, D. J. Bennett, S. A. Thomasma, S. L. Stout, J. F. Palmer, R. E. Hoffman, D. S. deCalesta, E. Gustafson, H. Cleveland, J. M. Grove, D. Nute, G. Kim, R. P. Kollasch. 2000. NED-1: integrated analyses for forest stewardship decisions, Computers And Electronics In Agriculture 27(1-3): 167-193.

Natural Resource Network

Connecting Research, Teaching and Outreach

2001 Workshop Proceedings Forest Measurements for Natural Resource Professionals

Caroline A. Fox Research and Demonstration Forest
Hillsborough, NH

Sampling & Management of Coarse Woody Debris – October 12

Getting the Most from Your Cruise – October 19

Cruising Hardware & Software for Foresters – November 9

UNH Cooperative Extension
131 Main Street, Nesmith Hall, Durham, NH 03824



The Caroline A. Fox Research and Demonstration Forest (Fox Forest) is in Hillsborough, NH. Its focus is applied practical research, demonstration forests, and education and outreach for a variety of audiences.

A Workshop Series on Forest Measurements for Natural Resource Professionals was held in the fall of 2001. These proceedings were prepared as a supplement to the workshop. Papers submitted were not peer-reviewed or edited. They were compiled by Karen P. Bennett, Extension Specialist in Forest Resources and Ken Desmarais, Forester with the NH Division of Forests and Lands. Readers who did not attend the workshop are encouraged to contact authors directly for clarifications. Workshop attendees received additional supplemental materials.

Sampling and Management for Down Coarse Woody Debris in New England: A Workshop- October 12, 2001

The What and Why of CWD- *Mark Ducey*, Assistant Professor, UNH Department of Natural Resources

New Hampshire's Logging Efficiency- *Ken Desmarais*, Forester/ Researcher, Fox State Forest

The Regional Level: Characteristics of DDW in Maine, NH and VT- *Linda Heath*, Research Forester, USDA Forest Service, Northeastern Research Station, Durham, NH

The Effects of Management on CWD for Wildlife Habitat- *Mariko Yamasaki*, Research Wildlife Biologist, USDA Forest Service, Northeastern Research Station, Durham, NH

How Do Silvicultural Methods Affect Amounts of CWD?- *Bill Leak*, Research Forester, USDA Forest Service, Northeastern Research Station, Durham, NH

Methods for Sampling CWD: LIS- *Mark Ducey*, Assistant Professor, UNH

Methods for Sampling CWD: The Relascope Connection- *Jeff Gove*, Research Forester, USDA Forest Service, Northeastern Research Station, Durham, NH

Getting the Most From Your Cruise- October 19, 2001

Pre-cruise Planning- *Mark Ducey*, Assistant Professor, UNH

Field Techniques- *John Bozak*, Professor, UNH Thompson School

What Do Your Results Mean?- *Ken Desmarais*, Forester/ Researcher, Fox State Forest

Writing an Integrated Prescription From Your Cruise Results- *Bill Leak*, Research Forester, & *Mariko Yamasaki*, Research Wildlife Biologist, USDA Forest Service, Northeastern Research Station, Durham, NH

Cruising Hardware and Software for Foresters- November 9, 2001

Forestry Tools- *Steve Bick*, Northeast Forests, LLC. Thendara, NY

Multicruise- *Tom Hahn*, FORECO

Flex-Fiber- *Tom Brann*, University of Maine University of Maine

Informal Use of Field Data Loggers- *Jeff Underhill*, Foresters Inc., Blacksburg, VA

Two-Dogs- *Jeff Underhill*, Foresters Inc., Blacksburg, VA

NED- *Mark Twery*, USDA-Forest Service, Northeastern Research Station, Burlington, VT

The Biotimber Inventory- *Andrea Alderman*, Society for the Protection of NH Forests

These workshops were co-sponsored by Fox Research Forest, part of the NH Department of Resources and Economic Development, Division of Forests and Lands, Forest Management Bureau; Granite State Division of Society of American Foresters; US Department of Agriculture, Forest Service; and UNH Cooperative Extension

Table of Contents

The What and Why of Coarse Woody Material by Mark J. Ducey.....	1
Down Dead Wood in Maine, New Hampshire, and Vermont: Regional Characteristics (1993-1995) by Linda S. Heath.....	5
Coarse Woody Debris on the Bartlett Experimental Forest by Mariko Yamasaki.....	8
Effects of Silviculture on Coarse Woody Debris by William B. Leak.....	12
Line Intercept Sampling for Coarse Woody Material by Mark J. Ducey.....	16
Sampling Down Coarse Woody Debris with an Angle Gauge by Jeffrey Gove.....	21
Field Techniques by John Bozak.....	26
What Do Your Cruise Results Mean? by Ken Desmarais.....	29
Writing Integrated Prescriptions from Your Cruise Results – or How Do I Recognize and Treat Wildlife Habitat Elements by Mariko Yamasaki.....	35
Stand-level Inventory Needs for Silvicultural Prescriptions by William B. Leak.....	39
Log Rule Tools and Timber Tools - Modern, Easy to Use and Inexpensive by Steven Bick....	42
MULTICRUISE – Multi-Product, Multi-Level Timber Inventory by Tom Hahn.....	44
Two Dog Forest Inventory Software by Jeff Underhill.....	45
Handheld Field Computers by Jeff Underhill.....	47
Rugged Handheld Field Computers vs. Palm/Pocket PC Handsets by Jeff Underhill.....	49
NED Software for Forest Management: Much More Than Cruising by Mark Twery and H. Michael Rauscher.....	51
The Society for the Protection of New Hampshire Forest's Biotimber Inventory (BTI) by Andrea Alderman.....	57

The Natural Resource Network Research Reports

The Natural Resource Network presents this material as a part of a series of research reports and publications of interest to educators, resource professionals, landowners and the public. Additional copies are available from the University of New Hampshire Cooperative Extension Forestry Information Center, 131 Main Street, Nesmith Hall, Durham, NH 03824.

The mission of the Natural Resource Network is to enhance interaction among the natural resource research, teaching, and outreach communities in New Hampshire by providing an ongoing mechanism for identifying, addressing and communicating natural resource issues.

Natural resource professionals are working toward improved ways to conserve and use the natural resources of New Hampshire. The Natural Resource Network was formed to improve the interaction among researchers and those who provide outreach education in many kinds of programs. Teachers, outreach professionals and resource managers can bring research-based education to diverse audiences. At the same time, those audiences, or consumers, identify issues and needs for educational programs which can be addressed by controlled research. Well informed and knowledgeable professionals, free-flowing exchange of information, an advantageous and gratifying professional environment, and natural resource planning are goals of the Natural Resource Network.

Karen P. Bennett
Extension Specialist
Forest Resources

UNH Cooperative Extension programs and policies are consistent with pertinent Federal and State laws and regulations on nondiscrimination regarding age, color, disability, national origin, race, religion, sex, sexual orientation, or veteran's status. College of Life Sciences and Agriculture, County Governments, NH Division of Forests and Lands, Department of Resources and Economic Development, NH Fish and Game Department, US Department of Agriculture, Forest Service and US Fish and Wildlife Service cooperating.

2000/2m

